

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : E21B 19/16		A1	(11) International Publication Number: WO 00/11311
			(43) International Publication Date: 2 March 2000 (02.03.00)
<p>(21) International Application Number: PCT/GB99/02710</p> <p>(22) International Filing Date: 16 August 1999 (16.08.99)</p> <p>(30) Priority Data: 9818363.5 24 August 1998 (24.08.98) GB</p> <p>(71) Applicant (<i>for all designated States except US</i>): WEATHERFORD/LAMB, INC. [US/US]; c/o CSC - The United States Corporation Company, 1013 Centre Road, Wilmington, DE 19805 (US).</p> <p>(71) Applicant (<i>for GB only</i>): HARDING, Richard, Patrick [GB/GB]; Marks & Clerk, 4220 Nash Court, Oxford Business Park South, Oxford OX4 2RU (GB).</p> <p>(72) Inventor; and</p> <p>(75) Inventor/Applicant (<i>for US only</i>): PIETRAS, Bernd-Georg [DE/DE]; Sandriedeweg 12, D-30900 Wedemark (DE).</p> <p>(74) Agent: LIND, Robert; Marks & Clerk, 4220 Nash Court, Oxford Business Park South, Oxford OX4 2RU (GB).</p>		<p>(81) Designated States: AU, CA, GB, NO, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published <i>With international search report.</i></p>	
<p>(54) Title: METHODS AND APPARATUS FOR CONNECTING TUBULARS USING A TOP DRIVE</p> <p>(57) Abstract</p> <p>An apparatus for facilitating the connection of tubulars using a top drive (3), the apparatus comprising a stator (11) attachable to said top drive (3), and a supporting member (24) for supporting a tool (4), wherein means (1) are provided to allow substantially horizontal movement of said supporting member (24).</p>			

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		

METHODS AND APPARATUS FOR CONNECTING TUBULARS USING A TOP DRIVE

This invention relates to methods and apparatus for facilitating the connection of
5 tubulars using a top drive and is more particularly, but not exclusively for facilitating
the connection of a section or stand of casing to a string of casing.

In the construction of wells such as oil or gas wells, it is usually necessary to
line predrilled holes with a string of tubulars known as casing. Because of the size of
the casing required, sections or stands of say two sections of casing are connected to
10 each other as they are lowered into the well from a platform. The first section or stand
of casing is lowered into the well and is usually restrained from falling into the well by
a spider located in the platform's floor. Subsequent sections or stands of casing are
moved from a rack to the well centre above the spider. The threaded pin of the section
or stand of casing to be connected is located over the threaded box of the casing in the
15 well to form a string of casing. The connection is made-up by rotation therebetween.

It is common practice to use a power tong to torque the connection up to a
predetermined torque in order to perfect the connection. The power tong is located on
the platform, either on rails, or hung from a derrick on a chain. However, it has recently
been proposed to use a top drive for making such connection either alone or in
20 combination with a power tong.

It has been observed that sections or stands of tubulars are often not as uniform
as desired. In particular, the sections or stands of tubulars are often not straight. The
top drive is in perfect alignment with the centre of the spider in the platform of an oil or

gas rig. However, a section or stand of tubulars located in the spider would not always be in alignment with the top drive.

According to a first aspect of the present invention there is provided an apparatus for facilitating the connection of tubulars using a top drive, the apparatus 5 comprising a stator attachable to said top drive, and a supporting member for supporting a tool wherein means are provided to allow substantially horizontal movement of said supporting member.

According to a second aspect of the present invention there is provided a method for facilitating the connection of tubulars using a top drive, the method comprising the 10 steps of attaching a tool to the top drive using a supporting member and adjusting the supporting member to cause the tool to be displaced horizontally relative to the top drive.

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the 15 accompanying drawings, in which:

Figure 1 is a side view in perspective of an apparatus in accordance with an embodiment of the invention in use;

Figure 2 is an enlarged view of parts of Figure 1, with parts inserted in a tubular and with parts cut away;

20 Figure 3 is an enlarged cross-sectional view in perspective of part of the apparatus of Figure 1;

Figure 4 is an enlarged view of parts of the supports of Figure 1 in a displaced position;

Figure 5 is an enlarged view of parts of the apparatus of Figure 1 in a second displaced position;

Figure 6 shows the apparatus of Figure 1 in a further stage of operation; and

Figure 7 shows a second embodiment of the present invention.

5 Referring to Figure 1 there is shown an apparatus which is generally identified by reference numeral 1.

The apparatus 1 depends from a rotor 2' of a top drive 3. A tool 4 for gripping a tubular depends from the lower end of the apparatus 1. A rigid guide member 5 is provided to guide the rotor 2 of the apparatus 1. The rigid guide member 5 is fast with a 10 stator 5' of the top drive 3. The rotor 2' of the top drive 3 is coupled by a threaded connection to the rotor 2 of the apparatus 1. The rigid guide member 5 may be provided with a clamp for clamping the rotor 2 of the apparatus 1 so that the threaded connection to the rotor 2' of the top drive 3 can be made, after which the clamp would be released.

15 An elevator 6 is provided on the end of bails 7, 8 which are hung from the top drive 3. Piston and cylinders 9, 10 are arranged between the bails 7, 8 and the top drive 3 for moving the elevator 6 from below the top drive 3 to an out of the way position.

Referring now to Figure 2, there is shown the apparatus 1 which comprises a plate 11 which is fixed to a connecting tubular 12 by a collar 13. The connecting tubular 12 passes through a hole 14 in rigid body 5 and connects with the rotor 2 (Figure 20 1). The plate 11 has two projections 15 and 16 which have holes 17 for accommodating axles 18 which are rotationally disposed therein. The axles 18 are integral with a rigid body 19. A slider 20 is arranged on runners 21 on either side of the rigid body 19. Arms 22 are connected at one end to the slider 20 via spherical bearings 23.

The other end of arms 22 are connected to a supporting member 24 via spherical bearings 25.

The arms 22 and are provided with lugs 26 to which one end of a piston and cylinder 28 and 29 is attached and are movable thereabout. The other end of each 5 piston and cylinder 28 and 29 is attached to lugs 30 and 31 and is movable thereabout.

The lugs 30 and 31 are fixed to plate 11.

A mud pipe 32 is provided between the plate 11 and the supporting member 24 for carrying mud to the inside of a tubular therebelow. The mud pipe 32 is located in cylindrical sections 33 and 34 which are attached to the plate 11 and the supporting 10 member 24. The mud pipe 32 is provided with a lobe 35 formed on the outer surface thereof and is located in a corresponding recess 36 in a cylindrical section 33 (Figure 3).

A lobe 37 is slidably arranged on the lower end of the mud pipe 32 with an o-ring seal 38 arranged therebetween to inhibit fluid from leaking therebetween. The lobe 37 is located in a corresponding recess 39 in cylindrical section 34. This arrangement allows 15 a ball and socket type movement between the plate 11 and the supporting member 24 and relative longitudinal movement therebetween.

Referring back to Figure 2, a tool 4 for gripping a tubular is fixed and depends from the supporting member 24 of the apparatus 1. Such a tool may be arranged to be inserted into the upper end of the tubular, with gripping elements of the tool being 20 radially displaceable for engagement with the inner wall of the tubular so as to secure the tubular to the tool.

In use, a tubular 40 to be connected to a tubular string held in a spider (not shown), is located over the tool 4. The tool 4 grips the tubular 40. The apparatus 1 and the tubular 40 are lowered by moving the top drive so that the tubular 40 is in close

proximity with the tubular string held in the spider. However, due to, amongst other things, manufacturing tolerances in the tubular 40, the tubular often does not align perfectly with the tubular held in the spider. The apparatus 1 allows minor vertical and horizontal movements to be made. The piston and cylinders 28 and 29 allow vertical movement, and may be controlled remotely. The piston and cylinders 28 and 29 may be of the pneumatic compensating type, i.e. their internal pressure may be adjusted to compensate for the weight of the tubular 40 so that movement of the tubular may be conducted with minimal force. Pneumatic compensating piston and cylinders also reduce the risk of damage to the threads of the tubulars. This can conveniently be achieved by introducing pneumatic fluid into the piston and cylinders 28 and 29 and adjusting the pressure therein. The piston and cylinders 28 and 29 may be hydraulic or may be hydraulic and provided with pneumatic bellows.

Tubular manipulating equipment such as stabbing guides may be used to direct the pin (not shown) of the tubular 40 into the box of the tubular string held in the spider. The apparatus 1 allows horizontal movement of the tubular 40 relative to the top drive 3. Once the tubular 40 is in line with the tubular string, the top of the tubular 40 may be brought in line with the top drive which may be carried out with pipe handling equipment. The top drive 3 is now in direct alignment with the tubular string held in the spider, and can now rotate the apparatus 1 and hence the tool 4 and the tubular 40 to perfect a connection between the tubular 39 and the tubular string.

Figure 4 shows the supporting member 24, the tool 4 and the tubular 40 laterally in a 'Y' direction out of alignment with the top drive 3. The mud pipe 32 has moved in recesses 36 and 39 and longitudinally in relation to o-ring seals 38. The piston and

cylinders 28 and 29 have moved about lugs 26, 27, 30 and 31. Arms 22 and 22' have moved about spherical bearings 23, 23', 25 and 25'.

Figure 5 shows the supporting member 24, the tool 4 and the tubular member 40 laterally in an 'x' direction. The mud pipe 32 has moved in recesses 36 and 39 and 5 longitudinally in relation to o-ring seals 38. The piston and cylinders 28 and 29 have moved about lugs 26, 27, 30 and 31. Rigid member 19 has moved about axles 18 and 18' and spherical bearings 23.

Figure 6 shows the elevator 6 swung in line with the top drive 3 by rotation of the piston and cylinders 9 and 10 acting on bails 7 and 8. The elevator 3 is located 10 below a box 41 of tubular 40. The tubular 40 may be released from engagement with the tool 4. The elevator 6 may now be raised to take the weight of the tubular 40 and tubular string. The tubular string may now be lowered into the well.

Figure 7 is a second embodiment of the present invention and is generally similar to that of Figures 1 to 6 further incorporating adjusting piston and cylinders 42 and 43 so that actuation of the piston and cylinders 42 and 43 can move the supporting member 24, the tool 4 and the tubular 40 depending therebelow in a horizontal plane in 15 an x and y axis.

The piston and cylinder 42 is arranged between the plate 11 and the rigid member 19 on lugs 44 and 45. Actuation of the piston and cylinder 42 moves the 20 supporting member 24, the tool 4 and the tubular 40 along a generally x-axis about axles 18 and 18'.

The piston and cylinder 43 is arranged between an extension of arm 22 and slider 20 on lugs 46 and 47. Actuation of the piston and cylinder 43 moves the supporting member 24, the tool 4 and the tubular 40 along a generally y-axis about

spherical bearings 23, and 25 and the corresponding spherical bearings arranged in arm 22'.

The piston and cylinders 42 and 43 may be hydraulically or pneumatically operable and may be controlled via a remote control unit (not shown).

- 5 In use, a tubular 40 may be gripped by the tool 4 in the way described above and lowered into close proximity with the tubular string held in a spider. The adjusting piston and cylinders 42 and 43 may then be actuated to obtain alignment of the pin of the tubular 40 with the box of the tubular string held in the spider. The tubular 40 may then be rotated to obtain a partial connection or be held in alignment with an additional 10 tool. The piston and cylinders 42 and 43 may then be returned to their original positions to obtain alignment with the top drive 3. The top drive 3 may then be used to torque the connection up to a predetermined torque to complete the connection.

It is envisaged that various modifications may be made to the above described embodiments, such as using a hydraulic motor in place of the supporting member 24.

CLAIMS

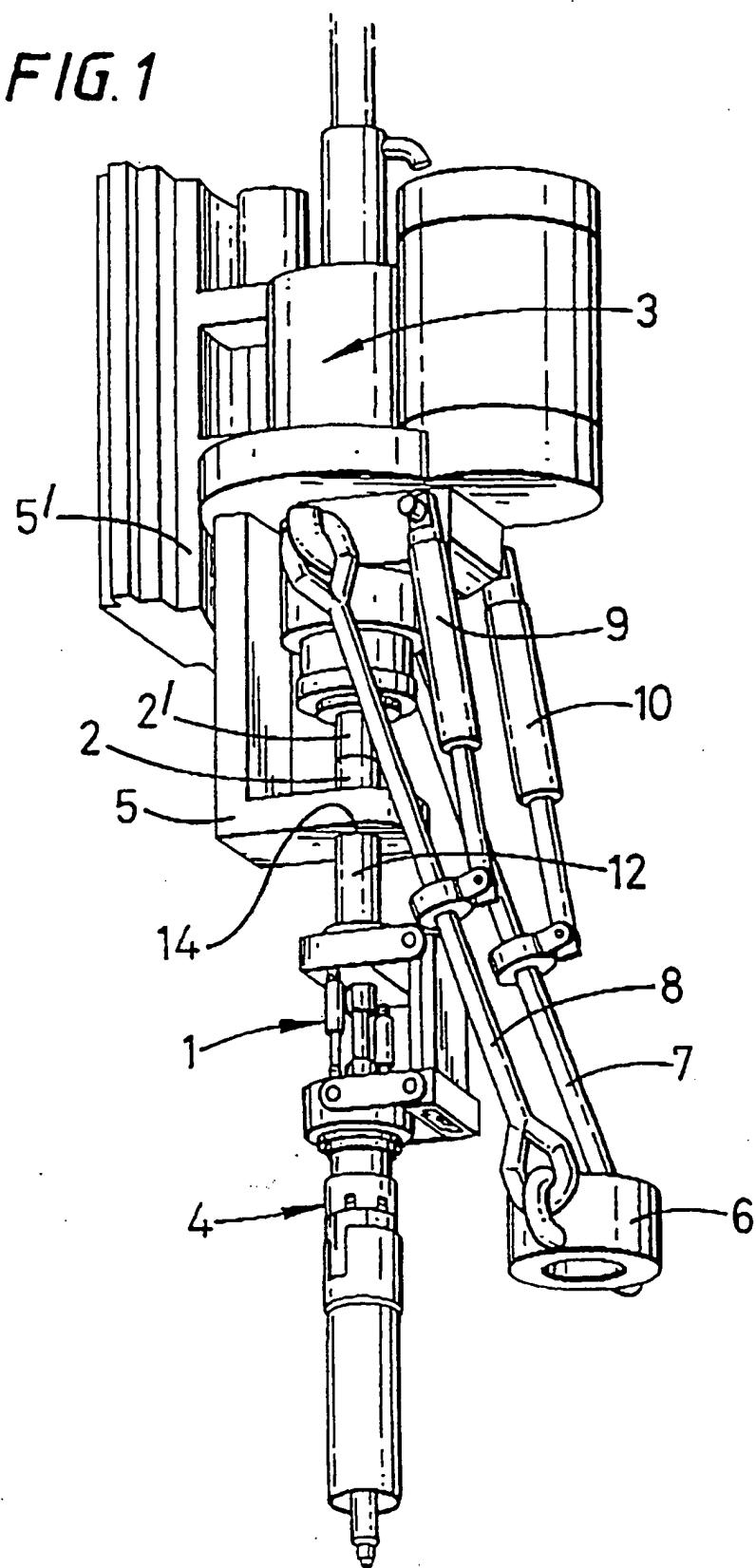
1. An apparatus for facilitating the connection of tubulars using a top drive, the apparatus comprising a stator (11) attachable to said top drive, and a supporting member (24) for supporting a tool (4) wherein means (1) are provided to allow substantially horizontal movement of said supporting member (24).
10
2. An apparatus as claimed in Claim 1 or 2, wherein said means (1) also allows substantially vertical movement of said supporting member (24).
3. An apparatus as claimed in Claim 1 or 2, wherein said means (1) comprises a rigid member (19) arranged between said stator (11) and said supporting member (24) and arranged on at least one axle (18, 18').
15
4. An apparatus as claimed in Claim 3, wherein said means (1) comprises at least one arm (22, 22') arranged between said rigid member (19) and said support member (24) and connected thereto by spherical bearings (25, 25').
5. An apparatus as claimed in any of Claims 2 to 4, wherein said means (1) comprises pistons and cylinders (28, 29) arranged between said stator (11) and said supporting member (24) to allow vertical movement of said supporting member (24).
20
6. An apparatus as claimed in any of Claims 2 to 5, further comprising a slider (20) to facilitate vertical movement of said supporting member (24).

7. An apparatus as claimed in any preceding claim, wherein a mud pipe (32) is arranged between said stator (11) and said supporting member (24).
- 5 8. An apparatus as claimed in Claim 7, wherein said mud pipe (32) is movable in relation to said stator (11) and said supporting member (24) about ball joints (35, 36, 37, 39).
9. An apparatus as claimed in any preceding claim, wherein said supporting 10 member (24) is a hydraulic motor.
10. An apparatus as claimed in any preceding claim including said tool (4).
11. An apparatus as claimed in Claim 10, wherein said supporting member (24) is 15 integral with said tool (4).
12. An apparatus as claimed in Claim 10 or 11, wherein said tool (4) is for gripping a tubular (40).
- 20 13. An apparatus as claimed in any preceding claim including a top drive (3).
14. A method for facilitating the connection of tubulars using a top drive, the method comprising the steps of attaching a tool to the top drive using a supporting

member and adjusting the supporting member to cause the tool to be displaced horizontally relative to the top drive.

1/7

FIG. 1



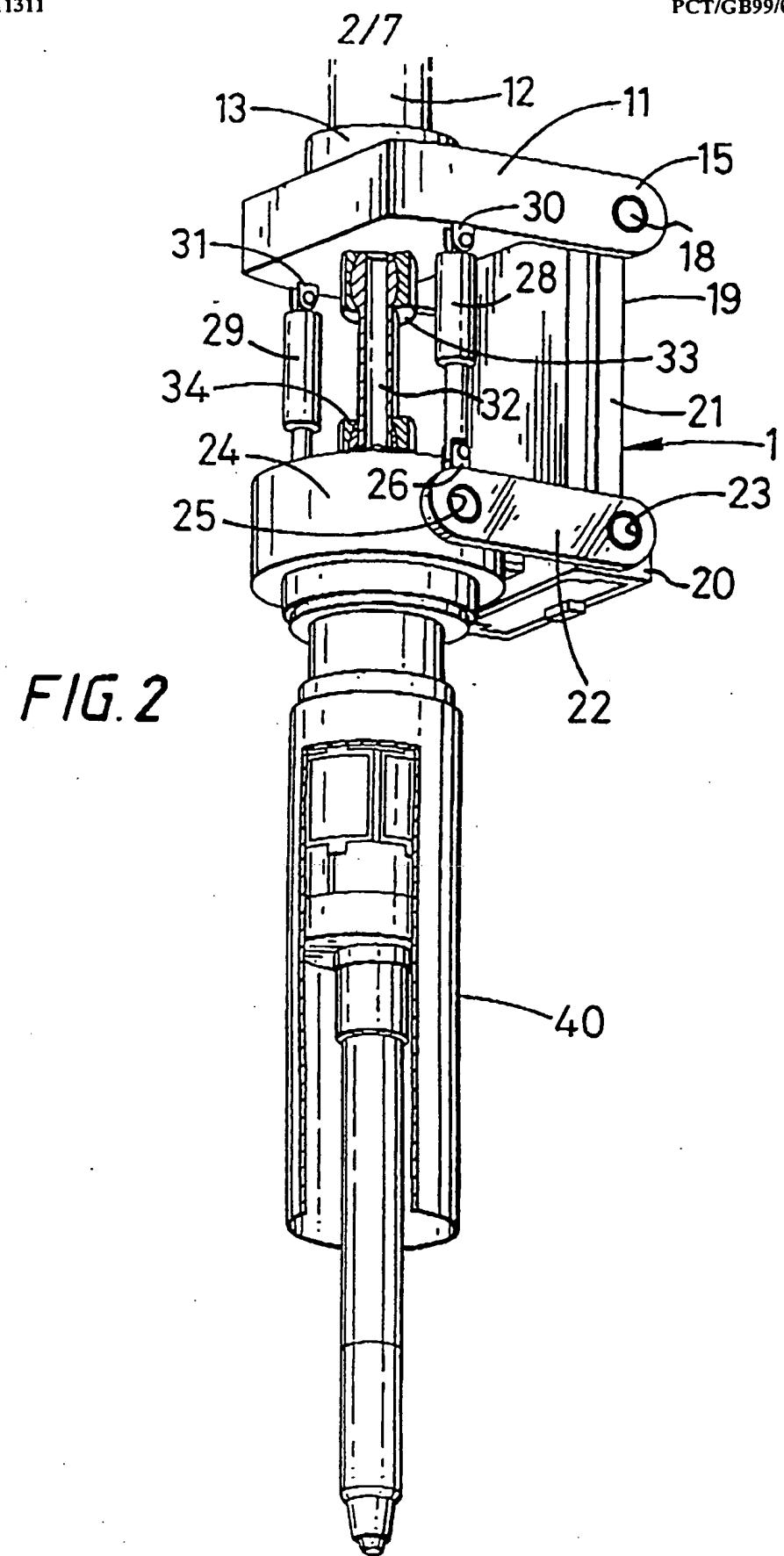


FIG. 2

3/7

FIG. 3

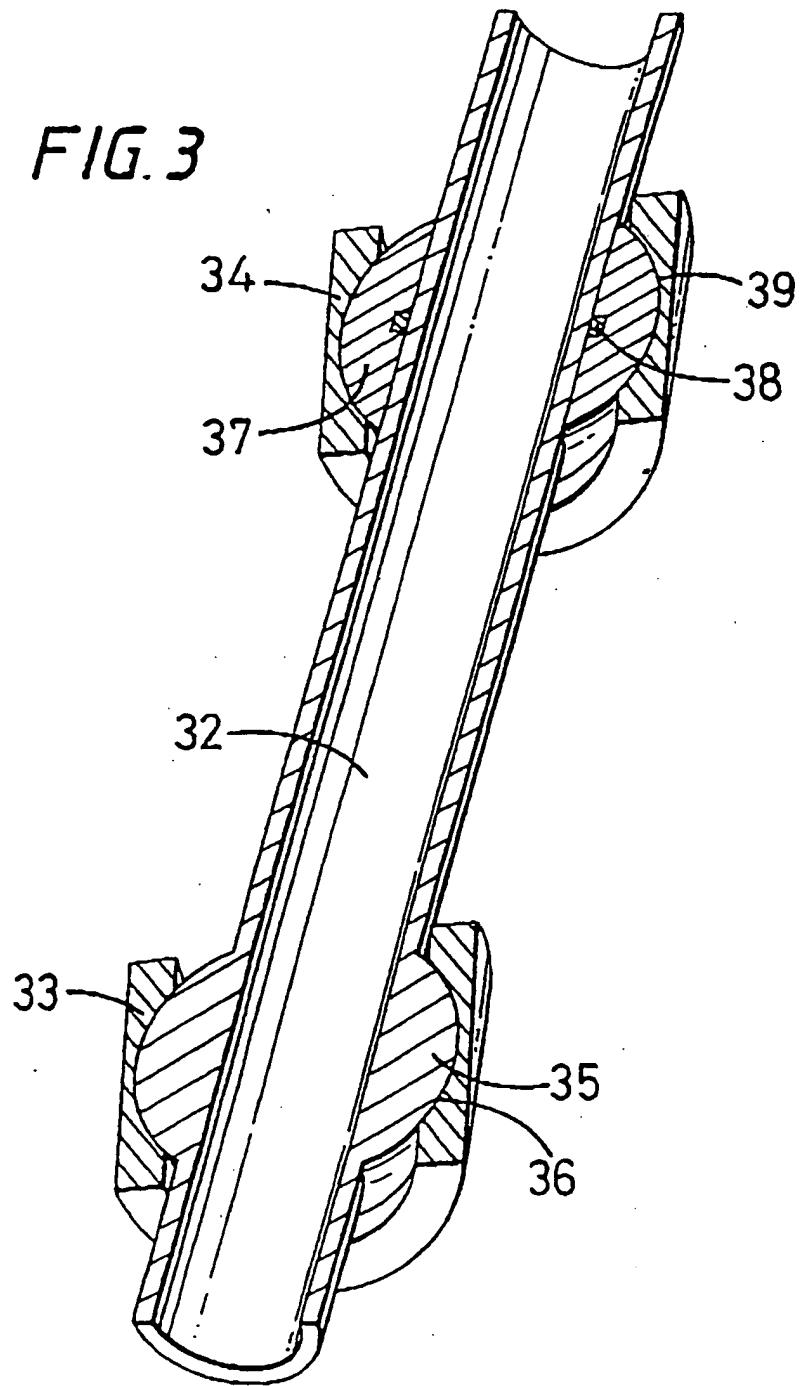
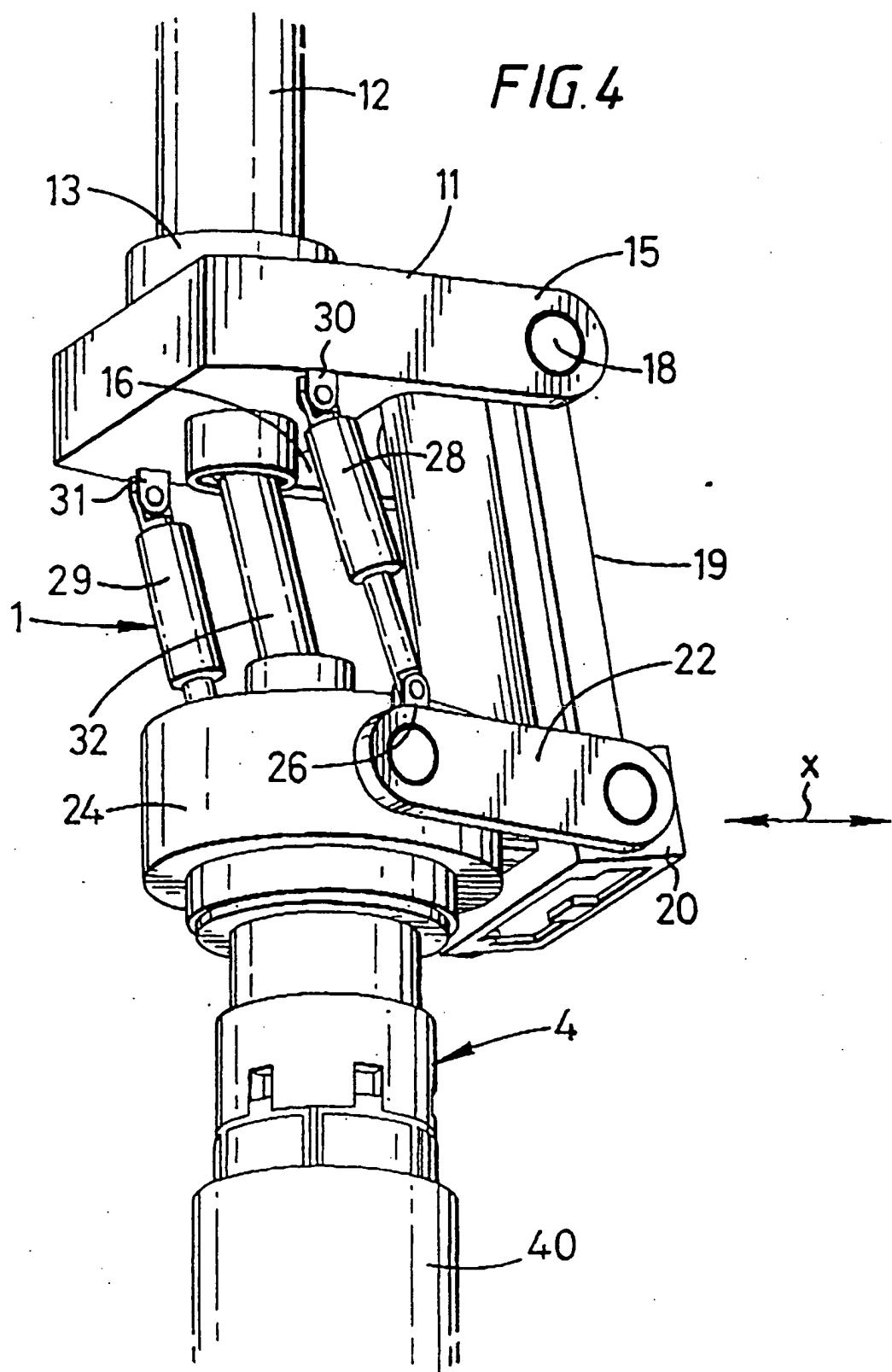


FIG.4



5/7

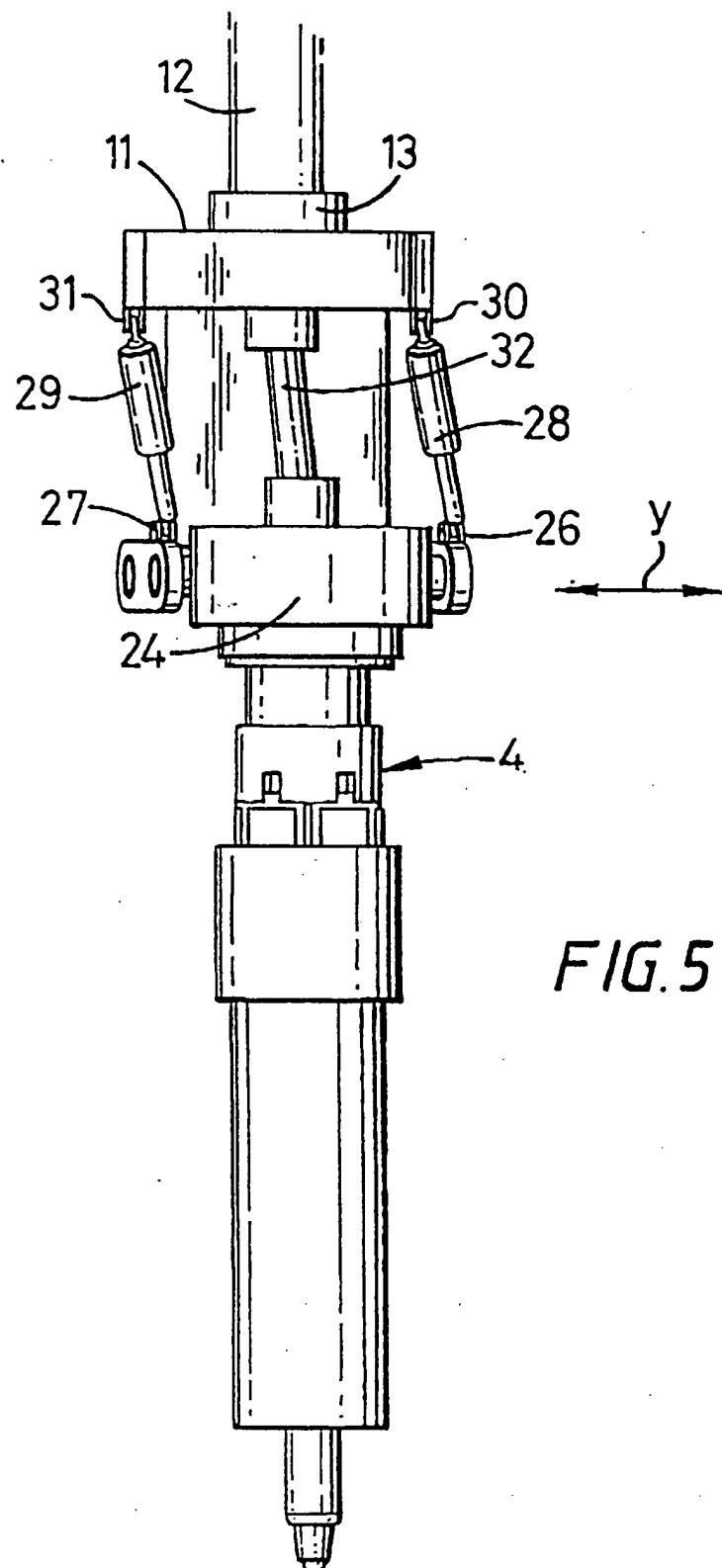
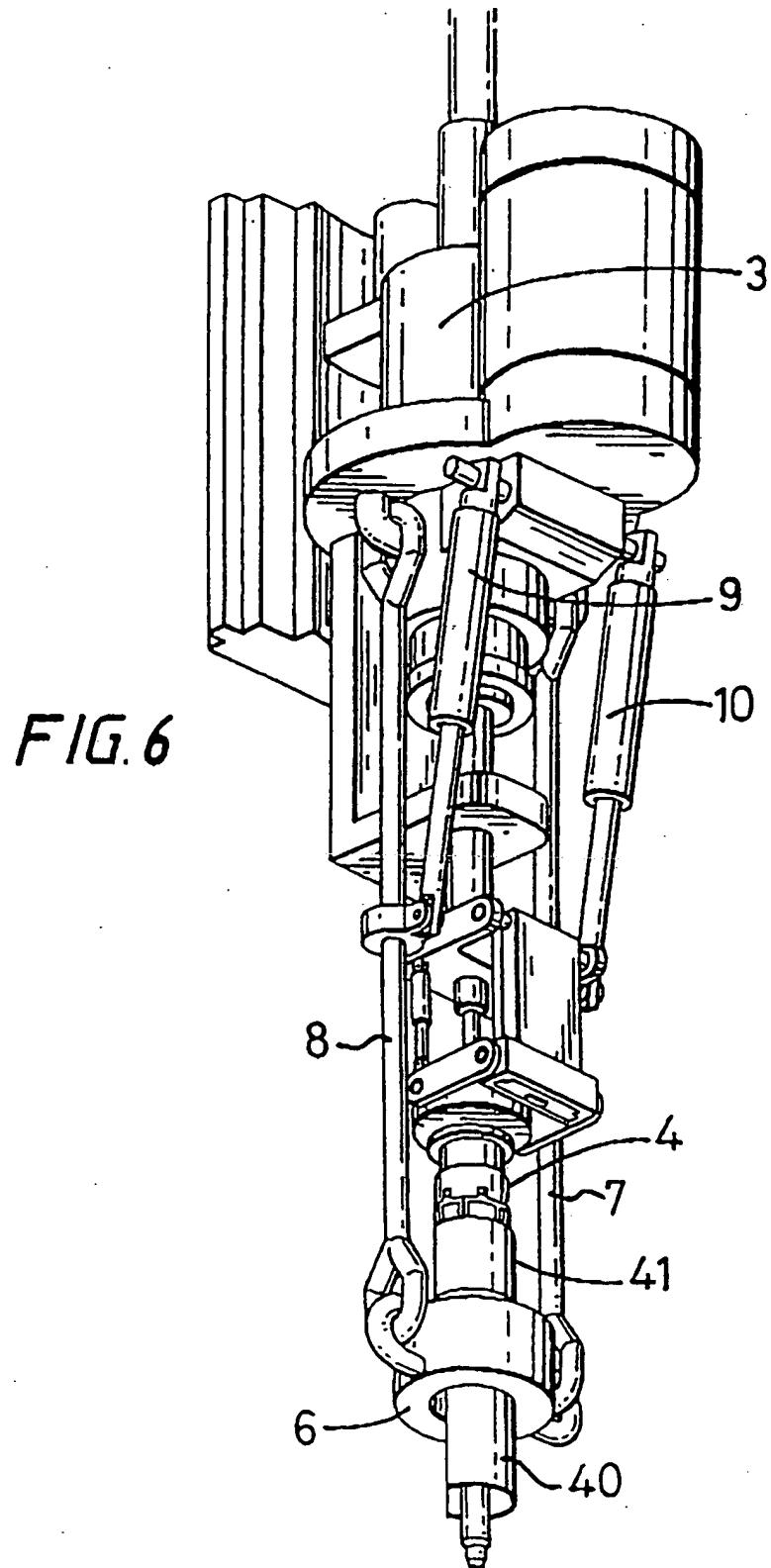


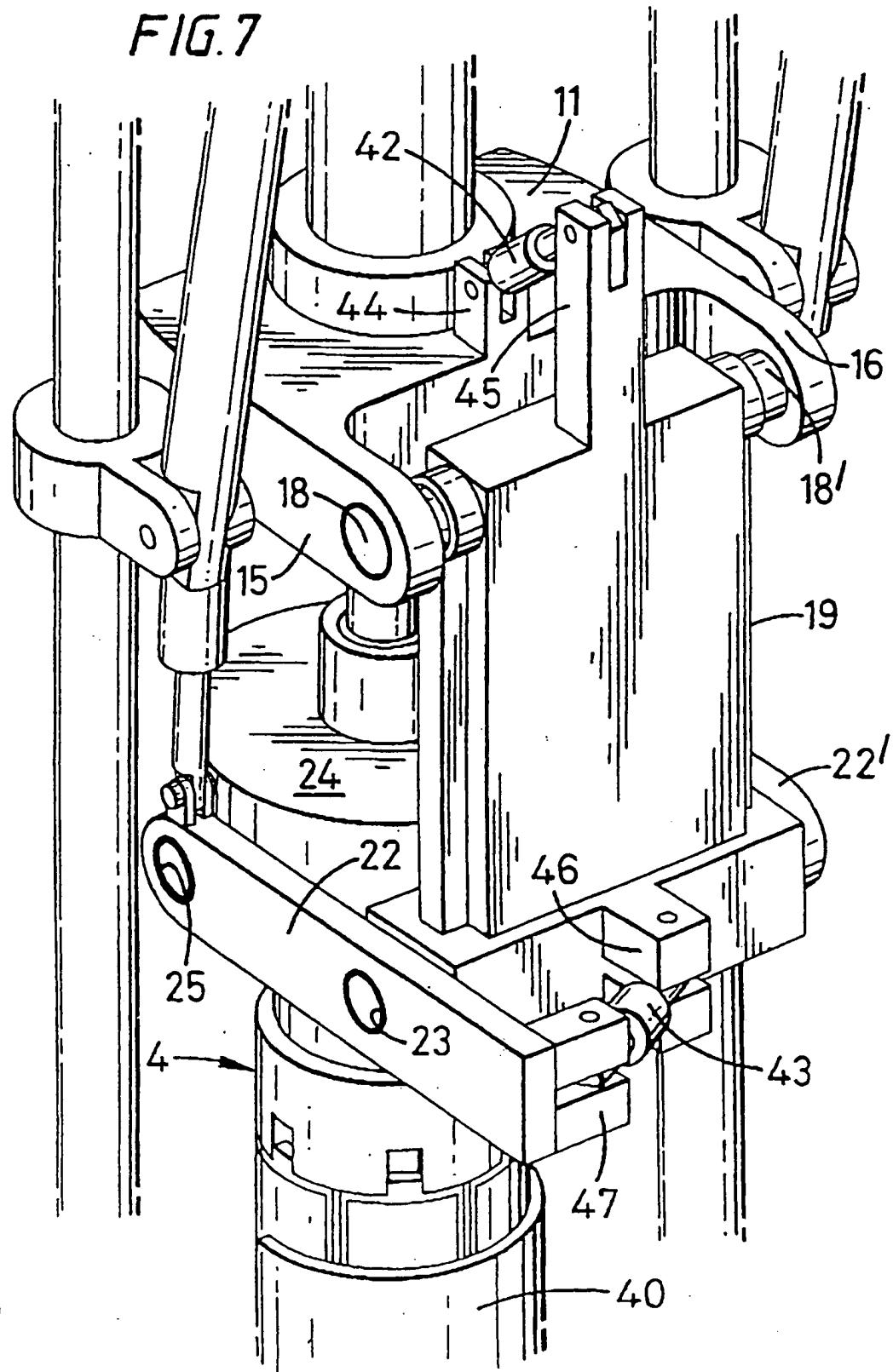
FIG. 5

6/7



7/7

FIG. 7



INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02710

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E21B19/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 878 546 A (SHAW DANIAL G ET AL) 7 November 1989 (1989-11-07) abstract figures 1-4 -----	1,14
A	WO 98 32948 A (PIETRAS BERND GEORG ;LUCAS BRIAN RONALD (GB); WEATHERFORD LAMB (US) 30 July 1998 (1998-07-30) abstract -----	1,14



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

& document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

19 November 1999

26/11/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.
Fax: (+31-70) 340-3016

Authorized officer

Schouten, A

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/02710

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 4878546	A	07-11-1989	NONE		
WO 9832948	A	30-07-1998	AU 5872898 A	18-08-1998	NO 993498 A 30-08-1999

THIS PAGE BLANK (USPTO)